Examples

Try out these examples to learn the basics of modeling oil spills in Santa Barbara Channel. Explore how the changing circulation modes alter an oil spill's trajectory, how wind can move an oil spill in a direction different from the currents, and how model and observation limitations can be overcome by considering both the "Best Guess" and the "Minimum Regret" (Uncertainty) solutions. This knowledge will help you in designing your own GNOME model runs.

The following conditions hold for each of the examples:
Run duration: 24 hours or less.
Wind: No wind, unless specified in a particular example.
Pollutant type: Nonweathering.

Use GNOME's Standard Mode and the Santa Barbara Channel Location File to answer the following questions:

1. Make a linear spill extending across the channel near the channel's east-west center.

How does your choice of current pattern affect the spill trajectory in the first 24 hours? (Pay particular attention to the difference between the Cyclonic and Milling patterns.)

Hint: To set a line spill, click and drag the spill tool from the starting point to the endpoint of your spill.

Hint: To change the current pattern, but keep all other Location File settings the same, double-click on "Location File" in the left section of the Map Window. The Location File Welcome window will appear with all the settings you had previously chosen. You only have to enter information that you are changing. You can then rerun the model with the same spill, under the same conditions, but with a new current pattern.

Answer: The direction and speed of currents along the northern and southern boundaries change with each current pattern, while few changes take place in the middle of the channel. This is because Santa Barbara Channel is wide enough that the northern and southern currents can act independently. The six current patterns in the Location File represent the most common combinations of northern and southern currents.

2. To investigate the effects of wind on oil spill movement, choose the Flood West pattern and set a spill at 34° 25.54'N, 120° 05.01'W. Gradually increase the wind from the south (by 10 knots each time) and examine where the oil impacts the beach.

How does changing the wind speed change the distance the spill travels before beaching?

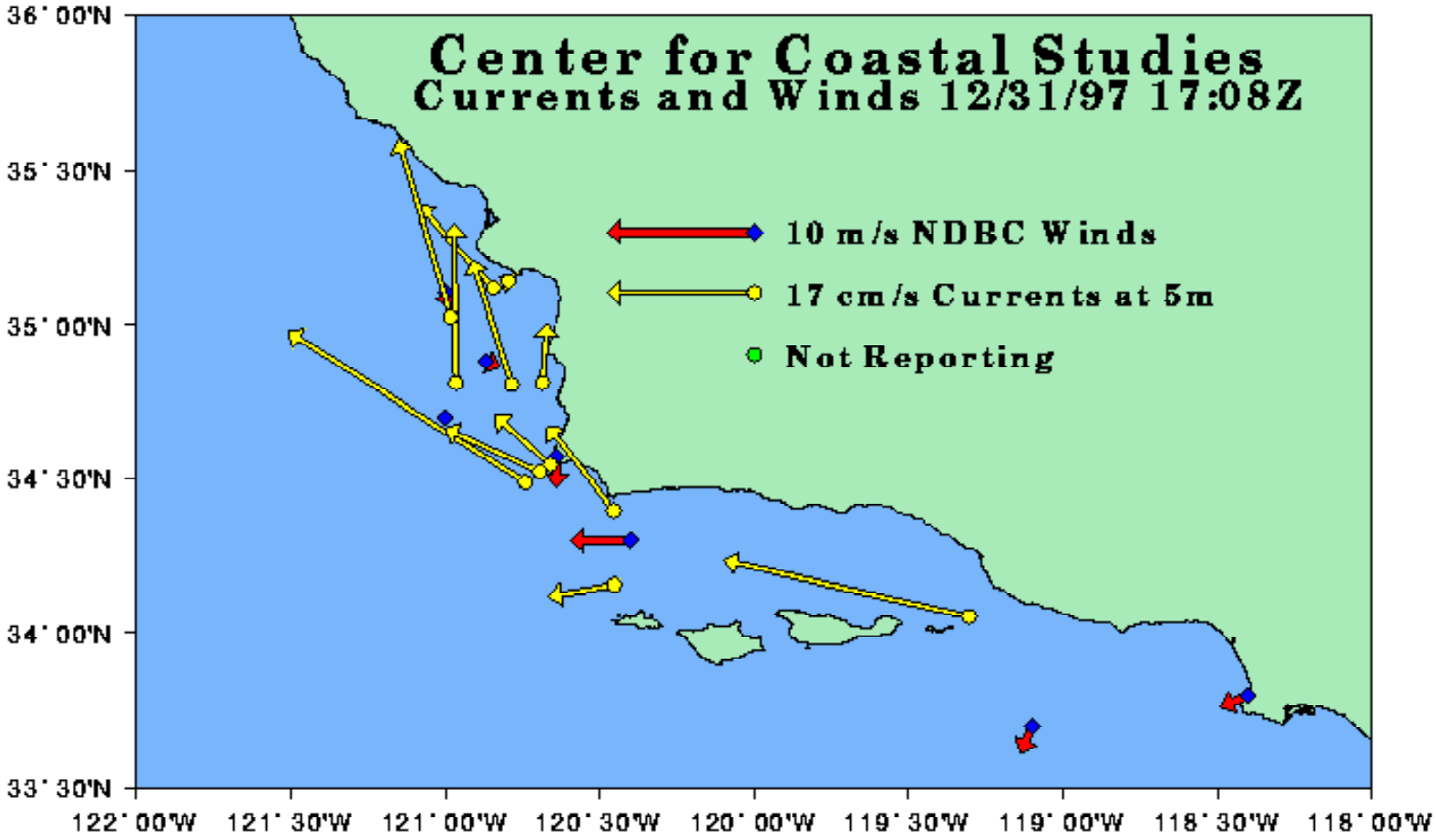
Hint: To set a spill at a particular position without using the mouse, double-click Spills in the left section of the Map Window. You can then enter the spill location in the Spill Information Window.

Answer: With no wind, the spill follows the coast, but does not impact the coastline. As the wind is increased, the impacts occur sooner after the spill occurs and closer to the spill site.

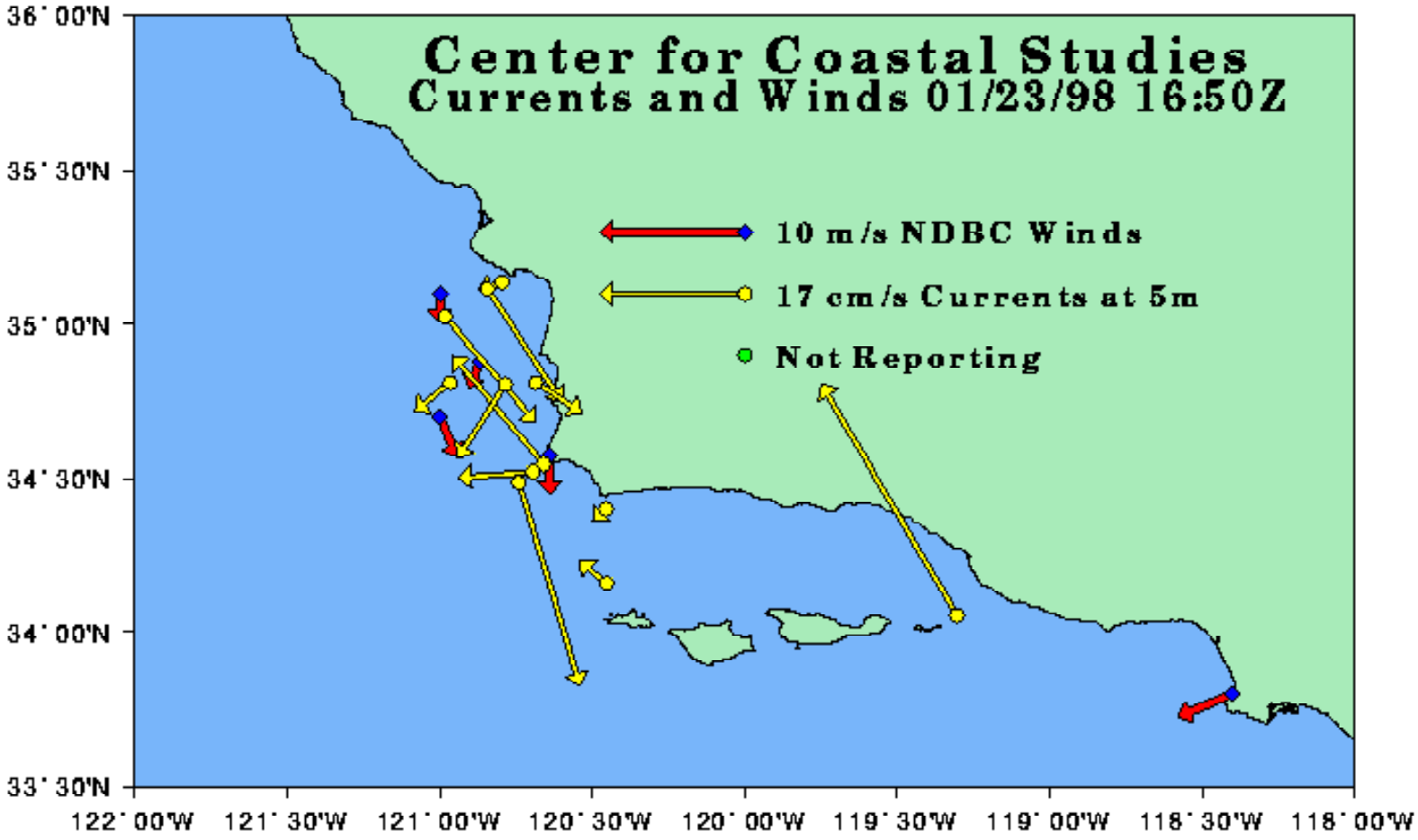
3. Below are some pictures of Santa Barbara Channel winds and currents (courtesy of the Center for Coastal Studies at the University of California at San Diego, and the Dept. of the Interior Minerals Management Service). **Use the pictures of the six current patterns in the Santa Barbara Channel Location File and the information in the "Selecting a Current Pattern" Help topic in the Location File to help you identify the current pattern in each picture.** You don't have to do all six examples in order to get an idea of how to do this task. As in real spill conditions, you may not have enough information to make an exact match, or the real conditions may vary from the classic definitions. In particular, the winds can change quickly, while the circulation and currents adjust to changes much more slowly.

Hint: The arrows on the pictures point in the direction that the wind or current is flowing. **The longer the arrow, the faster the flow.** To determine upwelling or downwelling conditions, orient the paper so that you are looking down the wind arrow from tail to point. The water flow due to Ekman transport (caused by the wind and the earth's rotation) will be to your (and the arrow's) right. Water moving toward the coast will cause downwelling; water moving away from the coast will cause upwelling.

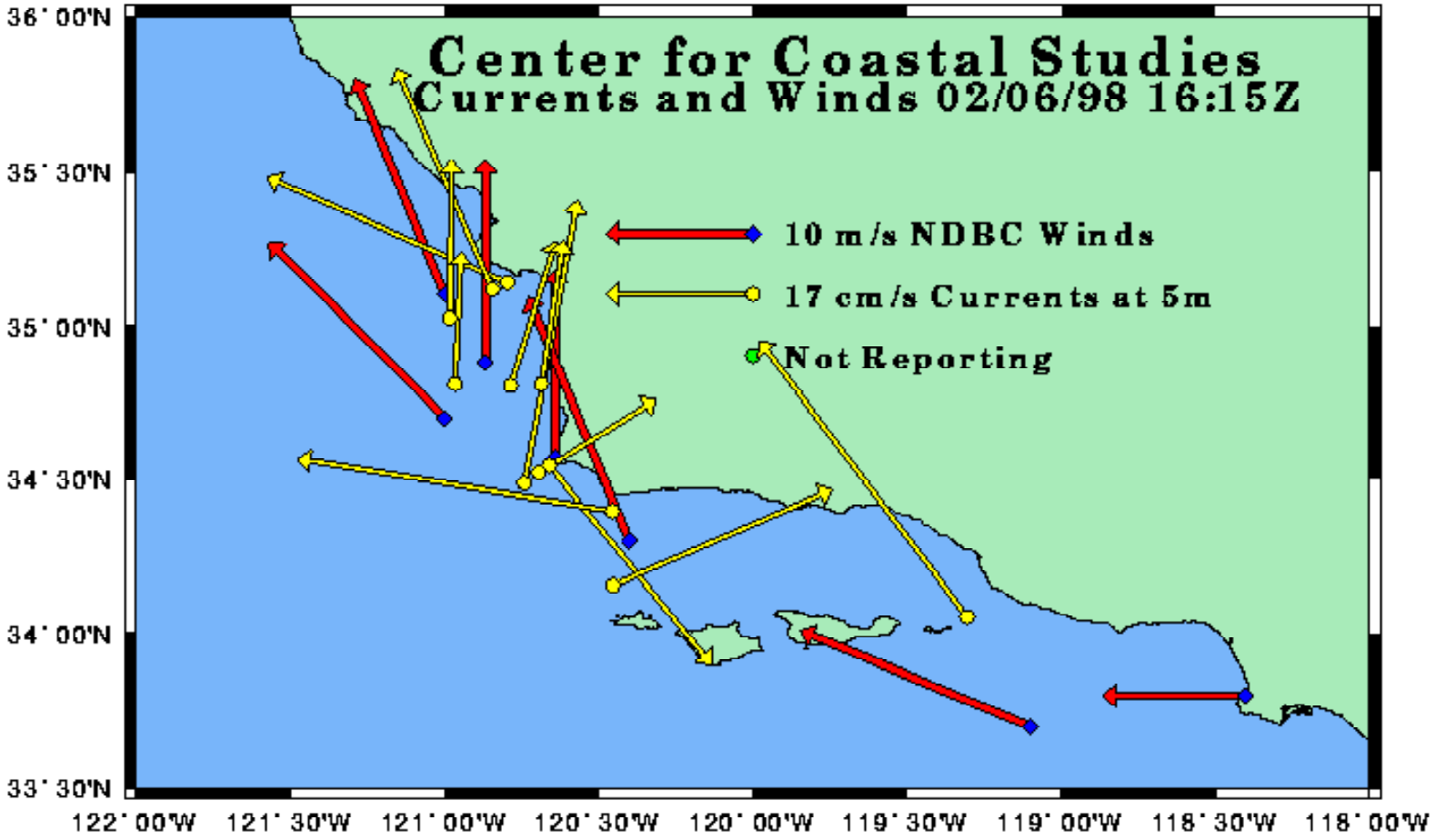
a. December 31, 1997



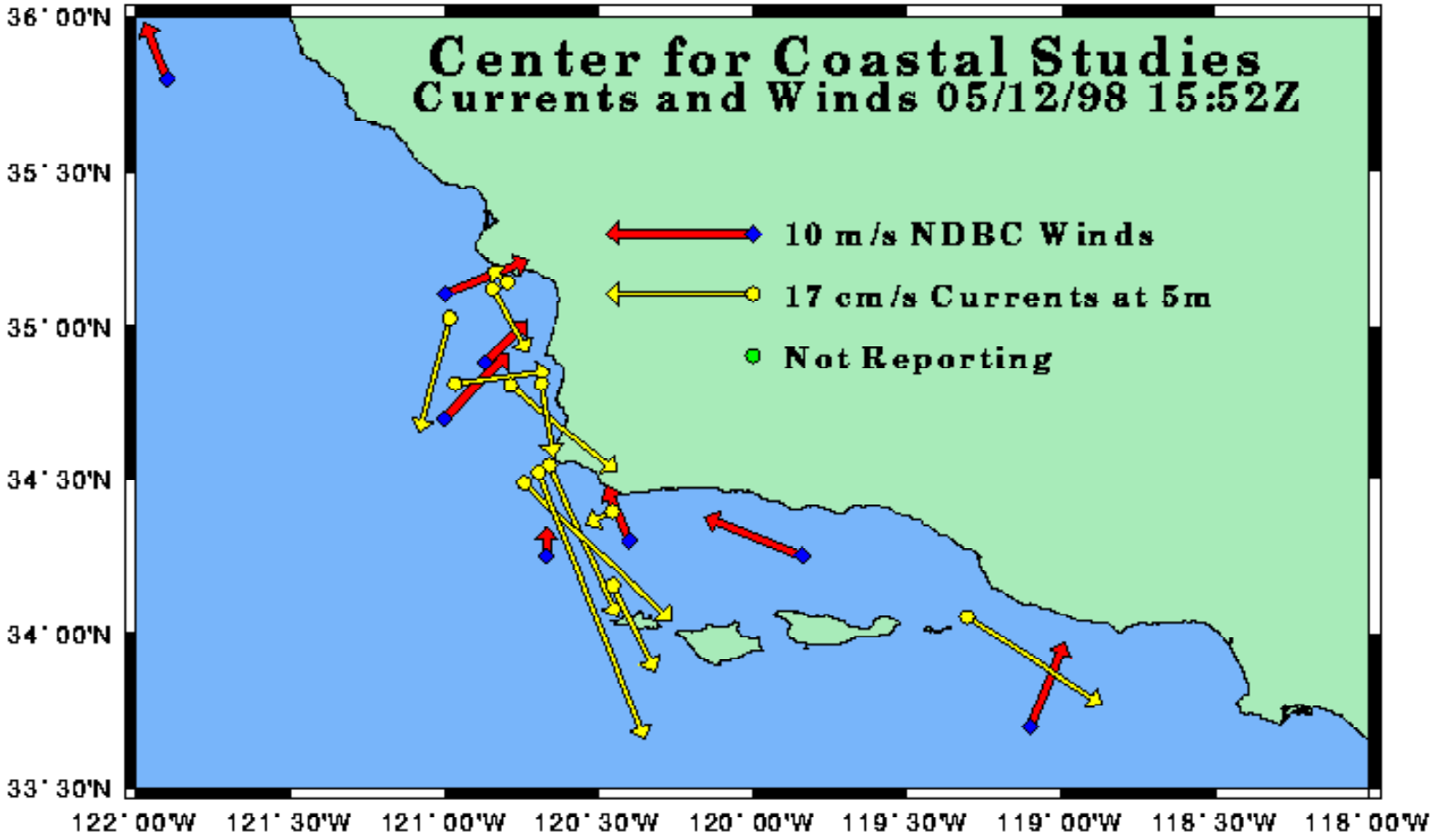
b. January 23, 1998



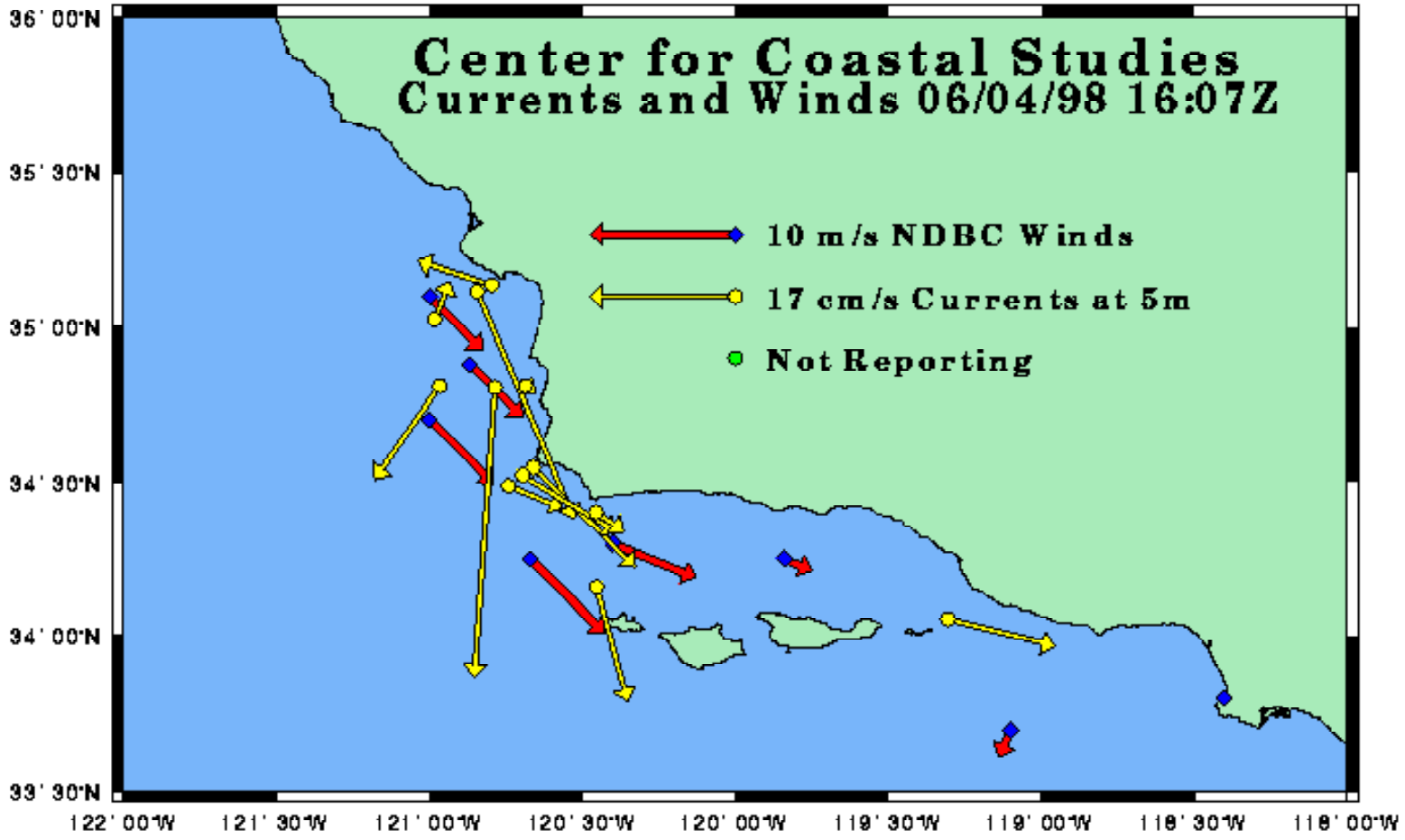
c. February 6, 1998



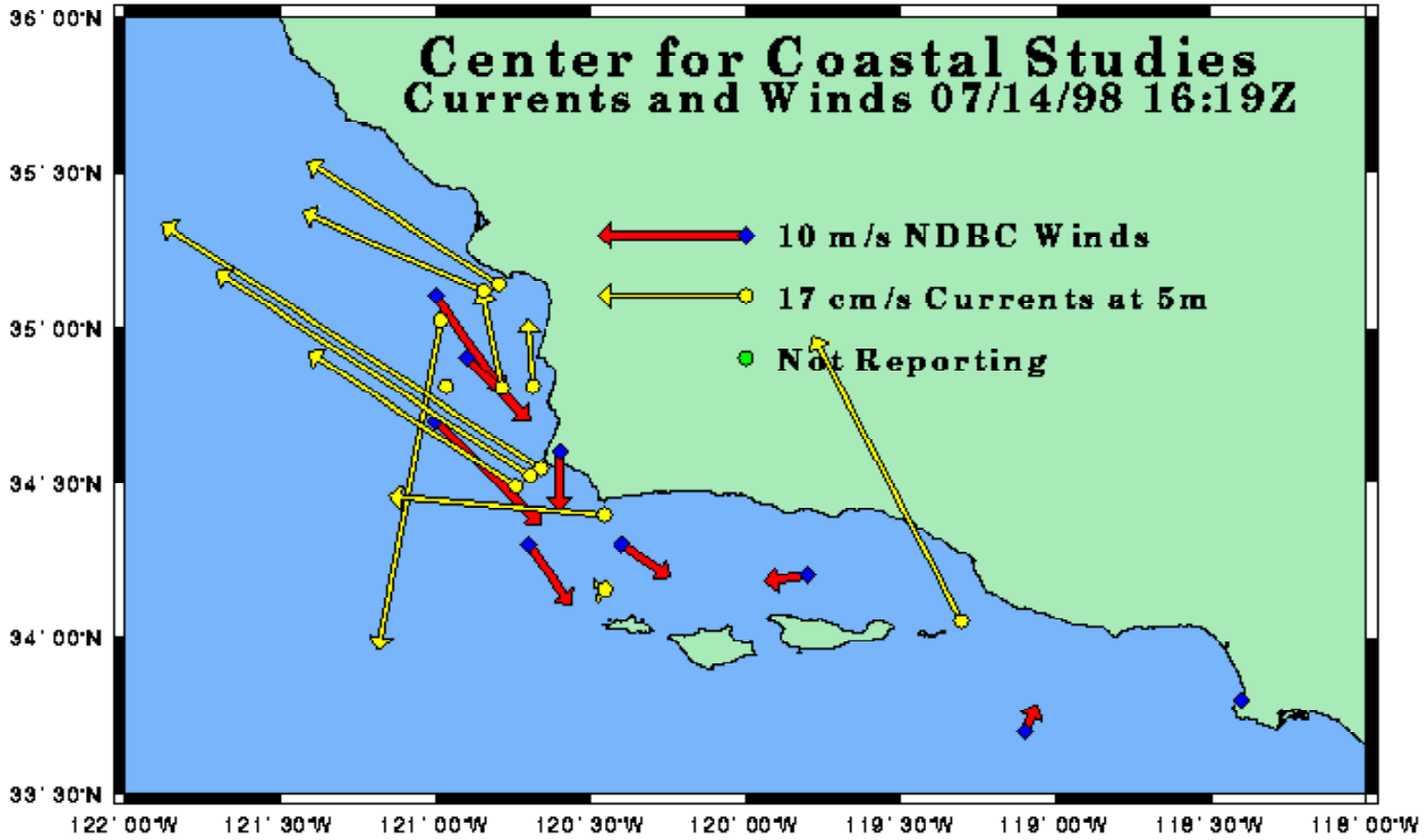
d. May 12, 1998


Center for Coastal Studies
Currents and Winds 05/12/98 15:52Z
10 m/s NDBC Winds
17 cm/s Currents at 5m
Not Reporting
36° 00'N
35° 30'N
35° 00'N
34° 30'N
34° 00'N
33° 30'N
122° 00'W
121° 30'W
121° 00'W
120° 30'W
120° 00'W
119° 30'W
119° 00'W
118° 30'W
118° 00'W

e. June 4, 1998


Center for Coastal Studies
Currents and Winds 06/04/98 16:07Z
10 m/s NDBC Winds
17 cm/s Currents at 5m
Not Reporting
36° 00'N
35° 30'N
35° 00'N
34° 30'N
34° 00'N
33° 30'N
122° 00'W
121° 30'W
121° 00'W
120° 30'W
120° 00'W
119° 30'W
119° 00'W
118° 30'W
118° 00'W

f. July 14, 1998



Answer:

a. December 31, 1997 - FLOOD WEST
Currents in the channel are directed along the coast toward the west. In this example, the wind stress is light and downwelling favorable, while the classic FLOOD WEST conditions have stronger winds.

b. January 23, 1998 - MILLING
Although the flow is nominally all in the same direction, the difference between the **strength** of the currents at the eastern and western entrances is striking. Flow through the eastern entrance is inward; the currents in the western entrance are of similar small magnitude, however, they are in different directions. This could be due to small eddies, which would fit the MILLING definition. Also, the winds are weak and upwelling favorable. Another possibility is FLOOD WEST, although the coastal flow to the west of the channel appears too disorganized. You may want to look at the pictures leading up to these conditions to make a more informed decision.

c. February 6, 1998 - CYCLONIC
The currents in the channel are all strong, with the flow inward at the eastern entrance, and in different directions between the two stations at the western entrance. This matches well with the CYCLONIC circulation pattern. The winds, however, are strong and downwelling favorable.

d. May 12, 1998 - UPWELLING
The southern channel currents are eastward and stronger than the northern westward circulation. This matches the UPWELLING current pattern. The winds, however, are weak to moderate and downwelling favorable.

e. June 4, 1998 - FLOOD EAST
The water flow is nominally inward to the channel at the western entrance, and outward at the eastern entrance. This indicates the FLOOD EAST current pattern. Winds are strong and upwelling favorable, which matches the classic definition.

f. July 14, 1998 - RELAXATION
The westward current in the northern portion of the channel is much greater than the eastward current that is barely detectable in the southern portion of the channel. The winds are moderate and upwelling favorable near the western entrance, which matches the classic definition.